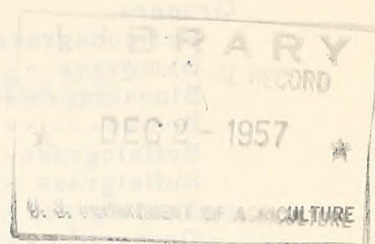


## Historic, archived document

Do not assume content reflects current  
scientific knowledge, policies, or practices.



15113  
R31A  
Exp. 2



# Grasses and Legumes

## For Forage and Conservation

ARS 22-43

October 1957

---

Agricultural Research Service  
UNITED STATES DEPARTMENT OF AGRICULTURE

# CONTENTS

<b>Grasses:</b>		<b>Sudangrass</b> - - - - -	14
Bermudagrass - - - - -	3	Switchgrass - - - - -	14
Bluegrass - - - - -	4	Tall oatgrass - - - - -	15
Bluestem - - - - -	4	Timothy - - - - -	15
Brome - - - - -	5	Wheatgrass - - - - -	15
Buffalograss - - - - -	7	Wild-rye - - - - -	17
Buffelgrass - - - - -	7		
Carpetgrass - - - - -	7	<b>Legumes:</b>	
Dropseed - - - - -	7	Alfalfa - - - - -	19
Fescue - - - - -	8	Clover, true - - - - -	21
Grama - - - - -	8	Crotalaria - - - - -	24
Hardinggrass - - - - -	9	Crown vetch - - - - -	24
Indian ricegrass - - - - -	9	Field peas - - - - -	24
Johnsongrass - - - - -	9	Guar - - - - -	25
Lovegrass - - - - -	9	Hairy indigo - - - - -	25
Meadow foxtail - - - - -	10	Kudzu - - - - -	25
Orchardgrass - - - - -	10	Lespedeza - - - - -	25
Pangolagrass - - - - -	11	Lupine - - - - -	26
Panicgrass - - - - -	11	Medicago - - - - -	27
Paspalum - - - - -	11	Roughpea - - - - -	28
Pearl millet - - - - -	12	Sesbania - - - - -	28
Redtop - - - - -	12	Sweetclover - - - - -	28
Rhodesgrass - - - - -	12	Trefoil, birdsfoot - - - - -	29
Ryegrass - - - - -	13	Trefoil, big - - - - -	30
St. Augustinegrass - - - - -	13	Vetch - - - - -	30
Stipagrass - - - - -	13	Index - - - - -	32



# GRASSES AND LEGUMES FOR FORAGE AND CONSERVATION

More than a billion acres in the United States are in grasses and legumes. Probably half of this vast acreage is covered with natural vegetation. The other half billion acres have been man-planted to grasses and legumes, or a mixture of the two, to provide feed for additional livestock numbers and to conserve the nation's soil.

For several years, agricultural leaders have been placing increased emphasis on the importance of expanding and improving our extensive acreages of grasses and legumes (1) as a means to more stable and economic production of livestock, and (2) to conserve the soil by improving its structure, increasing its fertility, and protecting it from the ravages of wind and water erosion.

Like other species of plants, grasses and legumes vary in their adaptation to climate and to soil types. Certain grasses and legumes perform better in the Great Plains than in the Southeast, and some grow better on clay than on sandy soils. Within the areas of general adaptation, certain species excel in production for hay, silage, and grazing. Others are better suited for erosion control or for the production of green manure.

This report is intended to serve as a guide to the selection of species and varieties of grasses and legumes adapted to a particular section of the country and to a particular use.

The new varieties of grasses and legumes listed possess specific superior characteristics such as disease resistance, winter hardiness, drought tolerance, seedling vigor, and persistence. Therefore, it is important to plant seed that is true to variety and well adapted to an area. Since it is usually impossible to differentiate between common seed and that of a superior variety, using certified seed is one of the surest ways of getting seed that is true to variety. All certified seed carries an official tag.

The species--and their varieties--included in this report were selected primarily for their usefulness as forage producers or conservation plants. Availability of seed was also considered. Many useful species, varieties, and strains are not listed because seed quantities are too limited. Those included that may be in short supply in coming years are indicated in the text; otherwise the seed supply is believed to be adequate.

All of the grasses and legumes are listed alphabetically by their common names. The order of listing moves from the broad to the narrow classification for each particular plant. Bluegrass, for example, is broken down into Kentucky bluegrass and big bluegrass. No varieties of Kentucky bluegrass are listed, but Sherman is listed as a subdivision of big bluegrass since it is a particular variety of big bluegrass. Not all of the grasses and legumes are subdivided into the more narrow classifications, but the means of identifying them are uniform.



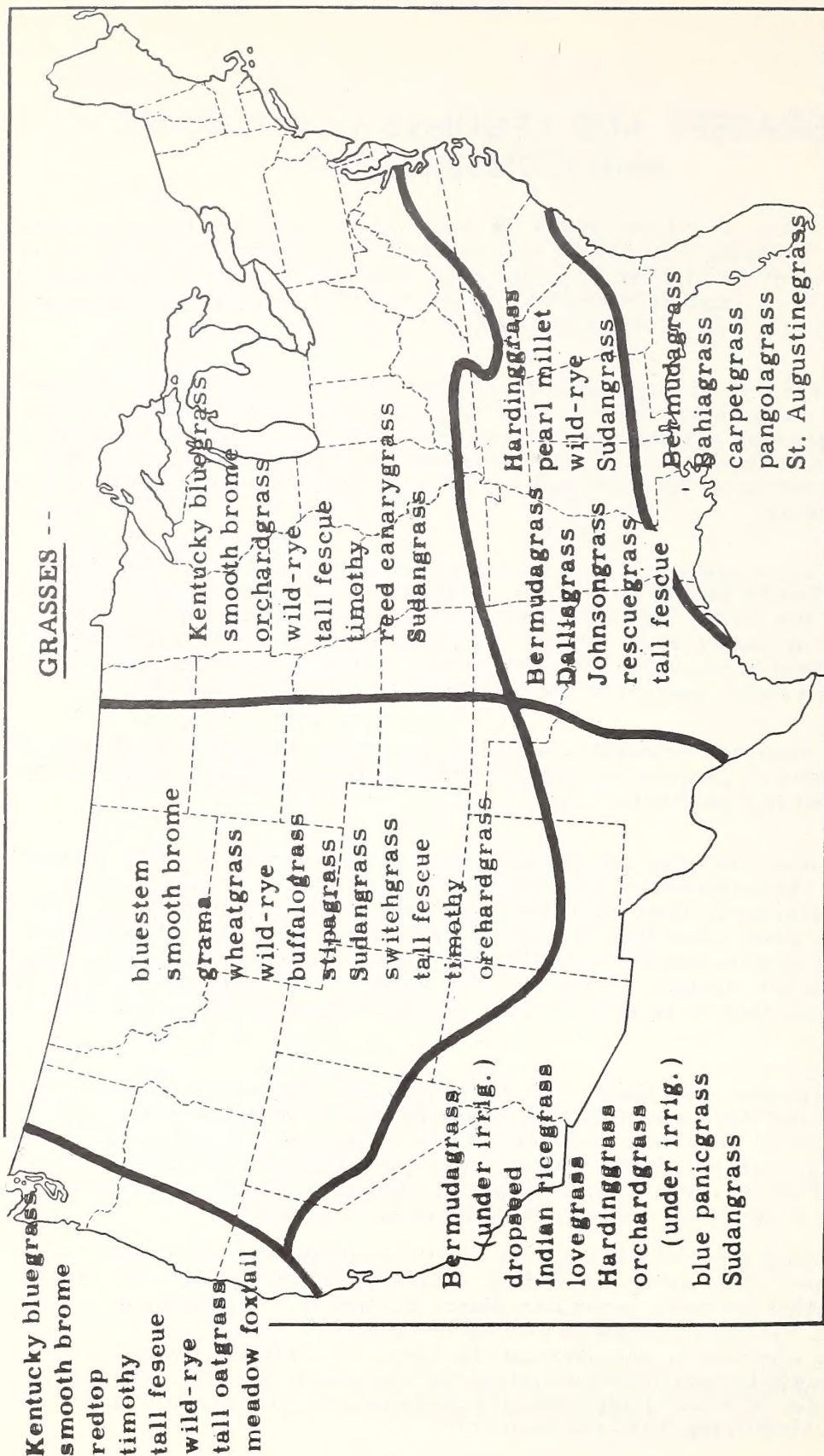


Figure 1.—Generalized regions of adaptation for principal grasses. Certain grasses may be adapted to only specific areas within regions.

## GRASSES

There are more than 1,500 grass species grown in the United States. They vary widely in their habits of growth, climatic adaptations, soil preferences, and uses. Almost all species are perennials, continuing or renewing their growth for several years, and most of them can be used in mixtures with other grass and legume seed.

### BERMUDAGRASS

Bermudagrass, which spreads vegetatively to form a dense sod, is found from Virginia to Kansas, south to the Gulf of Mexico, and in the irrigated sections of New Mexico, Arizona, and California. It grows well on almost any soil that is fertile and not too wet, and it is relatively salt tolerant. Most varieties require substantial amounts of nitrogen.

Bermudagrass is grown for hay, silage, and pasture. It does not start growth until late spring, grows profusely during hot midsummer weather, and stops growth as soon as cold weather begins in the fall. It is a palatable grass that toughens as it matures.

Common Bermudagrass is often difficult to control because it spreads rapidly by runners and reseeds itself. There are, however, four improved varieties adapted to various areas in the Southern States--Coastal, Suwanee, Midland, and Greenfield. The first three do not produce seed but all four varieties are increased vegetatively--by planting runners or crowns. Certified planting stock is available.

Coastal is the most popular variety of Bermudagrass. It is taller than common and is superior in disease resistance, frost tolerance, fall growth, rate of establishment, drought resistance, and forage yield. It is adapted to the heavier soils of the Cotton Belt as far west as central Texas, but it grows well on sandy soils if supplied with adequate amounts of nitrogen, phosphorus, and potash.

Suwanee is similar to Coastal in its growth habit, but it is better adapted to the sandy soils of the Cotton Belt.

Midland is a more winter-hardy variety than Coastal or Suwanee, and is adapted to areas farther north. It is being recommended for use in Oklahoma on soils of high fertility. Other States are currently running adaptability tests. Midland begins growth earlier in the spring than Coastal, is more drought-resistant, and has good disease resistance.

Greenfield is another variety that possesses a higher degree of cold-tolerance than Coastal and Suwanee. It is being recommended in Oklahoma for soils of low fertility, and appears to be adapted to areas in adjoining States.



## BLUEGRASS

The bluegrasses are widely grown in the United States and are among the most palatable of the pasture grasses. Kentucky and big bluegrass are the two most important kinds.

### Kentucky Bluegrass

Kentucky bluegrass, a sod-forming plant, is widely distributed in the area north of a line running through central Delaware, Maryland, West Virginia, Kentucky, and Missouri into eastern Kansas. It is also found in the mountainous sections of western Virginia, North Carolina, and eastern Tennessee.

Kentucky bluegrass does well under cool humid conditions and on well-drained, fertile, limestone soils. It will grow, however, on slightly acid land when provided with an ample supply of phosphorus. Used primarily in permanent pastures, it provides early spring and fall grazing, but is dormant during the heat of midsummer. It is palatable to livestock.

### Big Bluegrass

Big bluegrass grows in bunches 2 to 4 feet tall and is primarily adapted to eastern Washington, to Oregon, and to northern Idaho. Its adaptation to a wide range of temperature, moisture, and soil conditions and an extensive root system make it a good conservation plant for regrassing depleted range land. Its heavy forage production, palatability, and tendency to grow from early spring into the fall make it a good pasture plant as well. Since heavy grazing and severe trampling will injure stands, it should be grazed in moderation.

Sherman is a new variety that appears to possess an even wider geographic adaptation than common big bluegrass.

## BLUESTEM

The bluestems are important forage grasses in the Great Plains. Big, little, and sand bluestem are the principal native species. Turkestan, Caucasian, and Angleton are introduced bluestems.

### Big Bluestem

Big bluestem is a coarse bunchgrass found principally in the eastern half of the tier of States extending from North Dakota to Texas. The grass grows well on most soils but prefers moist, well-drained loams of relatively high fertility.

The plant provides pasture in the late spring and summer but tends to become unpalatable with advancing maturity. It makes good hay if mowed before the stemmy seed heads form, and provides good ground cover despite the fact that it is a bunchgrass. Seed supply varies from year to year.



## Little Bluestem

Little bluestem is a smaller version of big bluestem. However, it is more drought resistant, and as a result, it is adapted to drier sites in the bluestem States and also to a wide range of soil conditions. It has the same uses as big bluestem. Seed supply is variable.

## Sand Bluestem

Sand bluestem differs from little bluestem in that it possesses root-stocks. It is adapted to the belt of States extending south from North Dakota and eastern Montana to Texas and Arizona. It prefers medium-textured and sandy soils and serves both as a pasture and an erosion-control grass.

Woodward is a newly developed variety adapted to south-central and southwestern Kansas, western Oklahoma, eastern New Mexico, and the Texas Panhandle. It equals ordinary sand bluestem in forage yields and exceeds it in forage and seed quality and in seed yield. This variety is being increased, but seed supplies may be limited for some time.

## Turkestan Bluestem

Turkestan or yellow bluestem is finer stemmed than the native bluestems and has performed well in reseeding experiments in southern Kansas, Oklahoma, north Texas, New Mexico, and Arizona. It grows on a wide range of soils and is used for pasture, hay, and erosion control.

King Ranch is a productive and palatable variety, but it is not as cold hardy or drought resistant as common Turkestan. It prefers medium-to fine-textured soils but does well on sandy sites. It is an aggressive reseed and makes good growth in late summer and early fall. Its extensive root system makes it a good soil-building and erosion-control variety.

## Caucasian Bluestem

Caucasian bluestem is fine-stemmed like Turkestan and is adapted to the same climatic and soil conditions as little bluestem. It is more drought resistant and winter hardy than King Ranch Turkestan but less palatable. It can be used for grazing or for hay.

Medio, an improved variety, has finer leaves and stems, produces thicker turf, and appears to be somewhat more cold resistant than common Caucasian. Seed is in limited supply.

## BROME

The brome grasses are highly palatable plants used for pasture, hay, and conservation. The species includes mountain brome, rescuegrass, and smooth brome.



## Mountain Brome

Mountain brome is a native grass of the Rocky Mountain States. It is found in the mountainous areas of Montana, Wyoming, Colorado, New Mexico, Idaho, Utah, Arizona, Washington, Oregon, and Nevada. It is adapted to a wide variety of soils and does well on open ground and in open woods.

Bromar, which is being grown principally in Washington and Oregon, is taller, more leafy, more disease resistant, and about 2 weeks later in maturity than common mountain brome. It is particularly well-suited for use in sweetclover-grass mixtures for pasture and green manure.

## Rescuegrass

Rescuegrass is a short-lived sodgrass that is used as a winter annual in those States south of the southern boundary of Virginia, Kentucky, and Missouri, and in eastern Oklahoma and Texas. The plant prefers fertile well-drained soils, and provides pastures and ground cover in the fall, winter, and early spring. It is subject to smut, which reduces both seed yield and seed quality.

Lamont is a new variety selected for smut resistance. Seed supplies are being increased.

## Smooth Brome

Smooth brome, which is an excellent pasture and hay grass, has interlaced roots and runners that quickly form a coarse, dense sod. It is adapted to the Northern States, where it prefers moist, well-drained clay loams of relatively high fertility. It begins growth early in spring and continues through summer if sufficient moisture is available. Smooth brome is one of the more drought-resistant, cool-season grasses.

There are two general types of smooth brome--the Southern and the Northern. The Southern type is well adapted throughout the Corn Belt and the eastern Great Plains. The Northern type is well adapted to the States that border Canada and to higher elevations in the Rocky Mountain States. Seven varieties are important today. Only one of these--Manchar--is of the Northern type.

Achenbach and Fisher are varieties adapted to Ohio, Indiana, Illinois, and Missouri. Achenbach is equal or superior to Lincoln in this area. Seed supplies of both varieties are limited.

Lincoln is a high-yielding variety that forms a good sod and is tolerant of drought and heat. It is grown in the Dakotas and Nebraska and in States eastward to the Atlantic Ocean.

Lyon and Lancaster are new varieties that have been grown primarily in Nebraska. Both appear to outperform Lincoln in this area.

Southland is a leafy, high-yielding variety adapted to the southern part of the brome-grass area, including southern Kansas and eastern Oklahoma.



Manchar is a tall, leafy, semi-bunch grass that possesses good seedling vigor. It recovers quickly after cutting, does not rapidly become sod-bound and has some disease resistance. It is a heavy seed producer.

## BUFFALOGRASS

Buffalograss, a sod-forming plant, is found in the western half of the Dakotas, Nebraska, Kansas, Oklahoma, and Texas, and in the eastern edges of Wyoming and Colorado. It prefers the heavier soils and is highly resistant to drought and heat.

Buffalograss is usually too short to be used for hay, but it is adapted to a wide range of climatic conditions and makes a good pasture plant. Its aggressive spread, matted growth, and ability to withstand trampling make it a useful conservation and pasture plant.

## BUFFELGRASS

Buffelgrass is a warm-season bunchgrass adapted to the coastal areas of States bordering the Gulf of Mexico and to south-central Texas. It prefers clay or sandy soils, is drought resistant, but is subject to frost damage. The grass establishes easily, and provides summer pasture and hay. Seed is in fair supply.

Blue buffelgrass is a large erect variety that is somewhat more cold tolerant than other strains tested. It appears to prefer the heavy soils.

## CARPETGRASS

Carpetgrass, which has a creeping habit of growth and forms a dense sod, is grown from Virginia to Oklahoma and south to the Gulf of Mexico. Largest acreages are found on the coastal plains of States bordering the Gulf where sandy and sandy loam soils are found and where moisture is near the surface most of the year. Although it prefers a moist soil, it does not grow well in swampy areas. It is planted for permanent pasture and firebreaks.

## DROPSEED

Dropseeds derive their name from the plant's habit of casting the seed as it nears maturity. These hard-coated seeds may lie dormant for many years and then germinate when conditions become favorable. This characteristic enables the grass to perpetuate itself despite the unfavorable growing conditions found in its area of adaptability--the dry, hot sections of west Texas, Arizona, New Mexico, and southeastern California. The dropseeds are adapted to a wide range of soils and are used principally for pasture, but they may be used for hay if cut before the plants mature. Forage production is satisfactory but not outstanding in either quantity or quality. The plants are good for revegetation and are prolific seeders.

## FESCUE

The fescues vary widely in size, appearance, and growth habit. The narrow-leaved fescues are used principally for turf while the broad-leaved species are valued for grazing and forage. Tall fescue is the most important of the broad-leaved species.

### Tall Fescue

Tall fescue is an aggressive, erect, deeply rooted bunchgrass generally grown in those States south of the Ohio River and east of Kansas and Oklahoma. It is also grown in Washington, Oregon, and in irrigated sections of the Western States. Although adapted to semi-wet conditions, it is also drought resistant. The plant is used for pasture, hay, and conservation. In the North growth begins early in the spring and continues, with adequate moisture, until covered with snow. In the South it is used for winter pasture and is often planted with white clover. Reports indicate that under certain conditions and management practices, animal disorders have been associated with the pasturing of this grass.

Alta and Kentucky 31 are high producing fescues that are drought resistant and tolerant of both soil acidity and alkalinity. Adapted to a wide range of soil and temperature conditions, the two varieties are grown in those States south of the Ohio River and east of Texas. In addition, Alta is widely used in Oregon for reclaiming saltgrass meadows. Both varieties provide permanent pasture without reseeding and their stand improves after the first year.

Goar is coarser and somewhat more heat tolerant than Kentucky 31 or Alta. It is grown in California, Arizona, New Mexico, and Texas.

## GRAMA

The grama grasses are important range plants in the area west of a line extending through central North Dakota and south through Texas, except for that portion along the Pacific Coast. Although they are summer-growing grasses, they provide both summer and winter grazing, since they cure naturally on the ground.

### Sideoats Grama

Sideoats grama is a bunchgrass grown in western North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, and New Mexico. It is adapted to a wide range of soil and climatic conditions, and provides palatable pasture or hay.

Coronado is a tall, coarse-stemmed variety that has broad leaves and good rust resistance, and it is an excellent seed producer. It is adapted to parts of New Mexico, northern Texas, and Oklahoma. It prefers moist, rich soils but does well on sandy or gravelly soils where moisture is adequate. Seed is limited.

### Blue Grama

Blue grama, a sod-forming grass, is abundant in the same States where sideoats grama is grown. It is found on acid and alkaline soils, and prefers



the heavier rolling uplands. Highly drought-resistant, it occupies the drier sites within its range of adaptation.

Blue grama is a highly palatable pasture grass that will stand heavy grazing when established, but growth begins late in the season. Its persistence makes it a good conservation crop as well as a pasture plant. Locally grown seed should be planted. Plants from seed adapted to the Northern Great Plains will not do well farther south, and those from seed of southern origin are subject to winterkill in the North. Seed supply is highly variable.

### HARDINGGRASS

Hardinggrass, a bunch plant, is widely grown in parts of California that are subject to summer drought and winter rainfall. It provides winter pasture, withstands heavy grazing, and recovers rapidly after cutting. Mild winters and heavy, fertile soils are necessary to its cultivation. It makes maximum growth in cooler weather and provides palatable forage.

### INDIAN RICEGRASS

Indian ricegrass derives its name from its rice-like seeds which served as food for certain Indian tribes. A native bunchgrass, it is widely distributed over the States west of the Mississippi. It prefers dry sandy soils, is drought-resistant, and is somewhat tolerant of alkali. Its palatability makes it subject to overgrazing, but when properly managed it is a valuable pasture and conservation plant on sites where no other grass will grow.

### JOHNSONGRASS

Johnsongrass spreads by rootstocks and grows wherever cotton is produced and moisture is abundant. Once established it is difficult to eradicate. The plant can be used for hay or for pasture, but it does not tolerate heavy, continuous grazing. Johnsongrass may contain small amounts of prussic acid, but few cases of livestock poisoning are known to have resulted from feeding it.

### LOVEGRASS

Several species of lovegrass are grown in the Western States. They are recognized for their ability to produce an abundance of seed and forage on soils of low fertility and are used to provide vegetative cover on eroding sites. The species vary in palatability, which limits their use as forage grasses. Weeping, Lehman, and sand lovegrass are the most important species.

### Weeping Lovegrass

Weeping lovegrass is a bunchgrass widely planted in Oklahoma, Texas, New Mexico, and Arizona. It grows on soils varying from coarse sand to fine-textured silts and clays, and ranging from strongly alkali to highly acid and over a wide range of fertility. It is used for either conservation or pasture. Weeping lovegrass begins growth early in the spring and

remains green throughout the summer and fall. It will remain palatable if kept mowed or grazed. This grass resists summer heat and drought, survives temperatures as low as -11° F., establishes from seed, and quickly forms ground cover.

### Lehman Lovegrass

Lehman lovegrass is a bunchgrass and grows well in the semi-desert areas of New Mexico, Arizona, and Texas, where temperatures seldom go below freezing. It is smaller and less cold resistant than weeping lovegrass but is highly drought resistant. It grows well on sandy soils and reseeds itself. It is somewhat more palatable than weeping lovegrass and is used for pasture and conservation.

### Sand Lovegrass

Sand lovegrass is a native bunchgrass that occurs naturally on sandy soils in Nebraska, Kansas, Oklahoma, and adjoining States. It is a palatable and nutritious range grass.

### MEADOW FOXTAIL

Meadow foxtail is a bunchgrass that will produce medium dense sod. It is found in Washington and Oregon, in eastern North Dakota, South Dakota, Nebraska, and Kansas, and in States eastward to the Atlantic Coast. It grows best in cool, moist climates but is tolerant of shade and relatively high temperatures, and somewhat tolerant of salt. It is a wet-land grass that grows best on fertile, swampy soils. Used principally as a pasture plant, it begins growth early in the spring and provides leafy, succulent forage that is relished by all classes of livestock. It matures about a month earlier than timothy and is sometimes used for hay and silage.

### ORCHARDGRASS

Orchardgrass is a bunchgrass grown in the region which extends from southern New York State to the Carolinas and westward from the Atlantic Coast to eastern Kansas and southeastern Nebraska. It is also used for re-seeding logged-over lands in Washington and Oregon and for irrigated pastures in Utah, Idaho, Colorado, and New Mexico. It performs best on rich soil but also grows on light soil of medium fertility and on moist, heavy land. Since it does well in the shade, it is often planted in orchards and woodland pastures. It is one of the first pasture grasses to begin growth in the spring and continues growth until the first severe frost. It is more productive, can tolerate more heat and drought, and grows on less fertile soil than timothy. In addition to pasture, it is used for hay and silage.

Akaroa is a short, leafy, fine-stemmed, late-maturing variety that is adapted to California and the coastal areas of Oregon and Washington. It lacks winter hardiness.

Potomac is a rust-resistant variety. Total forage yield is equal or superior to common orchardgrass. The supply of certified seed may be somewhat limited in 1958. It is adapted throughout the orchard-grass belt.



## PANGOLAGRASS

Pangolagrass is a rapid growing and leafy plant which is cultivated in central and southern Florida, and which may be adapted to California. It is highly palatable, grows well on sandy soils, and is drought resistant. It is not frost resistant, requires fertilization to survive, and must be propagated vegetatively. It is used for pasture, and produces high yields of rapidly curing hay.

## PANICGRASS

The panicgrasses are found only in the warmer regions of the United States. The most important of them is blue panicgrass.

### Blue Panicgrass

Blue panicgrass (also known as giant panicgrass) is a coarse sod-forming grass that has thick, bulbous runners. It is adapted to Texas, New Mexico, Arizona, and some parts of southern Oklahoma. The plant requires fertile, well-drained soils and is a heavy nitrogen feeder. It is a good seed producer, establishes easily, and provides palatable pasture in the early spring. It grows well with sweetclover and alfalfa. It is also used to hold soils in washes and arroyos and as a windbreak, since it reaches a height of 9 feet.

## PASPALUM

The important paspalums are Bahiagrass and Dallisgrass. Both are grown in the warmer sections of the United States for forage and for conservation.

### Bahiagrass

Bahiagrass is a low-growing plant that forms a dense, tough sod and is used for pasture and conservation. It is adapted to the Carolinas and Georgia and to the States bordering the Gulf of Mexico. It performs better on the less fertile soils than either the improved Bermudagrass varieties or Dallisgrass, but responds to fertilization. It persists on droughty, sandy soils.

Argentine is a coarse variety that has done well in Florida. It is a prolific seeder in comparison with common Bahiagrass.

Pensacola is a tall variety that is more winter hardy and a heavier seeder than common Bahiagrass. It is planted for forage and for erosion control.

### Dallisgrass

Dallisgrass is a deep-rooted bunch-type plant that forms a loose sod under heavy grazing. It is grown in all the States from North Carolina to Oklahoma and south to the Gulf of Mexico, as well as in the irrigated

sections of New Mexico, Arizona, and California. Dallisgrass favors heavy soils that are too wet for Bermudagrass. It supplies palatable, nutritious grazing most of the summer. It is compatible with white clover, but the clover should not be seeded until the Dallisgrass is established. Frequent mowing will prevent ergot-infected seeds from maturing. These are injurious to cattle.

Louisiana B-230 yields more forage and produces better seed than common Dallisgrass. It also becomes established more quickly and can be grazed earlier. Seed supply is limited.

## PEARL MILLET

Pearl (or cattail) millet is an annual, which is cultivated in the Southern States as far north as Maryland and Arkansas and as far west as eastern Oklahoma and Texas. It requires a rich sandy loam for best growth and is capable of producing large amounts of highly nutritious and palatable forage which may be used for summer grazing or for silage. It produces a very coarse hay. Pearl millet is moderately drought resistant and is exceptionally free from disease.

Starr lasts longer in pastures, is more leafy than common pearl, and matures 4 to 6 weeks later. It is well adapted for summer grazing on the lighter soils of the Atlantic Coastal Plain.

## REDTOP

Redtop is the only important forage species of the bentgrasses. It is grown principally in those States north of the Ohio River and east of Kansas and Nebraska, and in Washington and Oregon. The grass will grow under a wide range of soil conditions and is especially adapted to poorly drained acid soils. It is used in some pasture mixtures because it emerges quickly and helps to form a cover that protects the soil until the slower-growing grasses become established. It is used for hay but is shorter-lived and lower yielding than most cool-season hay grasses.

## Reed Canarygrass

Reed canarygrass is a tall, coarse plant, grown extensively in the northern half of the United States. Largest acreages are in Oregon, Washington, northern California, Minnesota, Wisconsin, and Iowa. It prefers moist, cool regions but is not sensitive to heat or cold. A wet-land grass, it does well on peat and muck soils but also grows on high, well-drained soils in areas where there is ample moisture in the spring and early summer. Its long life, long grazing season, high yields, and fair palatability qualify it for use as a pasture plant. It is also used for silage and hay, but the plant should be cut early to avoid coarseness.

## RHODESGRASS

Rhodesgrass is a fine-stemmed, leafy, creeping plant that is adapted to the Gulf Coast from Florida to Texas, and to southern Arizona and California. It grows on well-drained peaty soils in Florida, on sandy soils



in south Texas, and on alkaline and saline soils in southern California. It serves as a hay, pasture, or conservation plant, withstands trampling, and recovers quickly from heavy grazing. However, it is subject to severe damage from Rhodesgrass scale.

## RYEGRASS

The two kinds of ryegrass most commonly planted are Italian and perennial.

### Italian Ryegrass

Italian ryegrass is an annual grown in most of the States east of the Dakotas, Nebraska, Kansas, Oklahoma, and Texas, and in Washington and Oregon. It prefers warm, moist growing conditions and well-drained rich soils. It is moderately salt tolerant. This grass produces large amounts of tender, palatable forage and will withstand heavy grazing. In the North it is sometimes used as a companion crop for permanent spring pastures and in the South for temporary winter pastures. In the Pacific Northwest it is a valuable hay plant. In all of these areas it may also be used for green manure and as a temporary poultry range. It is less winter hardy than timothy or orchardgrass.

### Perennial Ryegrass

Perennial ryegrass is coarser and less palatable than Italian. It is short-lived and behaves as an annual in States east of the Dakotas-to-Texas tier. In Washington and Oregon, where largest acreages are grown, it behaves as a perennial. It prefers cool, moist regions with mild winters, and heavy fertile soils. It is not suited to hot, dry weather or sandy soils. Perennial ryegrass is slightly inferior to timothy for hay, but it supplies good spring pasture and quick cover for conservation purposes.

## ST. AUGUSTINEGRASS

St. Augustinegrass is a creeping plant grown in Georgia and States bordering the Gulf of Mexico. On the muck soils of the Florida Everglades it provides pasture and forms a dense sod which withstands trampling. It requires heavy fertilization and ample moisture for best growth. Stands are obtained by planting rooted runners.

## STIPAGRASS

The stipagrasses, or needlegrasses, are grown in the States of the North Dakota-to-Texas tier as well as many of the States to the west. They prefer sandy soils and rank high as pasture and hay grasses because of their abundance, wide distribution, long growing period, and capacity to cure well on the ground. A serious objection, however, is their needle-like awns which injure grazing animals.

### Green Needlegrass

Green needlegrass, or feather bunchgrass, is a green and leafy plant found on the upland prairies of the Dakotas, Nebraska, Montana, Wyoming,

and Colorado. It is adapted to all soil types but makes its best growth on the sandier soils. It is valued as a pasture and hay plant because its seed awns are not so large or troublesome as those of the other stipagrases.

Mandan is superior to common green needlegrass in vigor, size, and yields of forage and seed. Stands are easy to establish, and seedlings can take considerable abuse from blowing soil and grass-hopper attacks. Mandan starts growth about a week later in the spring than crested wheatgrass in the same area and reaches maturity about 3 weeks earlier.

## SUDANGRASS

Sudangrass is a summer annual grown throughout the United States. Largest acreages are in the semi-arid regions of the Dakotas, Nebraska, Kansas, Oklahoma, Texas, and Colorado.

It grows well on fertile loam and sandy or heavy clay soils but does poorly on wet or highly alkaline sites. It may be used for pasture, hay, or silage. Sudangrass is very drought tolerant and makes rapid growth from late seedings. Plants may contain toxic quantities of prussic acid after a severe drought or frost.

Piper is a variety having a lower prussic-acid potential, a greater production potential, and a higher degree of resistance to leaf blight and anthracnose than common Sudangrass. It is an important variety in the Dakotas and Nebraska and in all States to the east.

Greenleaf is a vigorous, leafy variety that is highly resistant to leaf diseases. It matures later than most varieties and is particularly adapted to Kansas.

Wheeler is an older variety that is early and dry stemmed, but it is susceptible to leaf diseases. It is grown principally in Kansas and Colorado.

Lahoma is a sweet, wide-leafed, late-maturing variety which is quite resistant to the leaf diseases and insects normally encountered in Oklahoma and Texas. It yields less than common Sudangrass but the forage is of better quality.

Sweet 372 is a highly palatable variety that produces a heavy crop of seed, and possesses some resistance to foliage diseases, charcoal rot, and chinch bugs. It is grown extensively in Texas.

Tift is a late-maturing variety that is noted for its disease resistance and for its high yields in those States south of the Ohio River and in eastern Oklahoma and Texas.

## SWITCHGRASS

Switchgrass is a sod-forming plant grown principally in western Nebraska, Kansas, Oklahoma, and Texas, and in eastern Colorado and New Mexico. It occurs on almost all soil types but thrives best in low moist areas of relatively high fertility. It furnishes grazing early in the spring,



and also through the summer if there is sufficient moisture. Switchgrass can be harvested for hay, but it should be cut when the seed heads begin to form. The plant's heavy root system makes it a good conservation plant.

Caddo is a tall upland switchgrass that is leafy and productive. It has considerable rust resistance and is a heavy seed producer. Caddo yields heavily under irrigation and recovers well after mowing. It is adapted to Oklahoma.

Blackwell is a productive variety similar to Caddo but is somewhat less resistant to rust. It is adapted to Kansas.

Nebraska 28 is a small, fine-stemmed variety, suited for pasture or for erosion control. It is adapted to the State for which it is named.

## TALL OATGRASS

Tall oatgrass is a short-lived bunchgrass grown to a limited extent in all except the arid and semi-arid sections of the country. It prefers sunny sites and rich, well-drained sandy soils. Its use varies slightly with the section of the country in which it is grown. In Washington and Oregon it provides hay and pasture. In New York and New England it is planted with legumes to provide early spring grazing. In the States south of Virginia, Kentucky, and Missouri and east of Oklahoma and Texas it provides winter grazing and hay. The forage is considered palatable and nutritious, but the grass has a peculiar taste to which grazing animals must become accustomed.

Tualatin is an improved variety whose seed shatters less readily than common tall oatgrass, but it produces slightly less forage.

## TIMOTHY

Timothy is an important bunchgrass adapted to the cool humid climate of the northernmost tier of States from Maine to Minnesota, the northern portion of adjoining States, and Washington and Oregon. It is also found in the valleys of the Rocky Mountains. It grows best on clay loams and tolerates acid soils. It is cold tolerant, requires ample moisture in the growing season, and does not withstand close grazing. It provides leafy and highly palatable hay.

## WHEATGRASS

The wheatgrasses are grown in the Dakotas, Nebraska, Kansas, Montana, Wyoming, Colorado, Idaho, Utah, Nevada, in eastern Washington and Oregon, and at higher altitudes in New Mexico, Arizona, and California. They are adapted to a wide range of moisture conditions and temperatures, and serve as pasture or conservation plants.

### Crested Wheatgrass (*Agropyron desertorum*)

Crested wheatgrass is a hardy bunchgrass adapted to the cool, dry sections of the wheatgrass area. It does well on all types of soil except hard

clays and coarse sands and is moderately tolerant of alkaline soils. The plant provides spring and fall pasture or hay. It is also useful for regrassing abandoned and burned-over rangelands. Hay quality is good if harvested soon after the heads form. Crested wheatgrass is highly resistant to drought, cold, and disease.

Nordan is a variety that yields more and higher quality forage and seed than common crested wheatgrass. It is also noted for its good emergence.

### Fairway Wheatgrass (*A. cristatum*)

Fairway wheatgrass, sometimes known as Fairway crested wheatgrass, is adapted to the same region as crested wheatgrass, but is grown primarily at higher elevations of the Rocky Mountain area. It is used for hay or pasture, or as a conservation plant. This grass is shorter, more leafy, and smaller stemmed than common crested wheatgrass, and its seeds have more pronounced awns. It is adapted to the same soil types as crested wheatgrass.

### Intermediate Wheatgrass

Intermediate wheatgrass is a sod-forming type and is adapted to all parts of the wheatgrass area. It makes its best growth on fertile, well-drained soils, and serves as a pasture, hay, or conservation crop. It is vigorous and easily established, and provides a dense ground cover during the first year. It is resistant to lodging, disease, and frost, but it is less drought resistant than crested wheatgrass.

Greenar is more vigorous and productive than common intermediate wheatgrass but is slower to form sod. It is planted in western Washington and Oregon, either alone or in combination with alfalfa.

Ree starts growth early in the spring, continues during the heat of summer, and makes its most rapid growth in late summer and fall. The plant is easily established, makes a rapid recovery after cutting or grazing, and is a prolific seed producer. It has performed well in South Dakota.

Nebraska 50 is a variety particularly adapted to western Nebraska and parts of adjoining States.

### Pubescent Wheatgrass

Pubescent or stiffhair wheatgrass has short, thick runners and is adapted to all parts of the wheatgrass area. Useful as a pasture or conservation grass, it is noted for its ability to survive dry, hot, and windy summers in areas where the soil bakes. It performs well on burned-over rangeland and on wind-blown, eroded sites.

Topar is a late-maturing, tall-growing variety. It is particularly adapted to Idaho and western Washington where it does well over a wide range of elevations.



## Tall Wheatgrass

Tall wheatgrass is a coarse, nonlodging bunchgrass that is adapted to all parts of the wheatgrass area and to a wide variety of soil conditions. It produces high yields on subirrigated alkaline soils and is very tolerant of salt. It provides green feed in summers and for fall grazing since it matures late in the season. It is fairly palatable and provides hay of fair quality if cut before it blooms. It is also used for conservation and erosion control on abandoned, wind-eroded sites. The grass has yielded favorably on sagebrush and mountain lands in Idaho, Utah, Colorado, and Nevada; it has been rated from poor to good in the ponderosa pine area in Colorado and in northern New Mexico and Arizona; it has not yielded satisfactorily on Wyoming's dry sagebrush and salt desert shrub range. Seed does not mature at high elevations.

## WILD-RYE

The wild-rye grasses are grown principally in the Western States. They are adapted to a wide range of soil types, are relatively easy to establish, and are useful for pasture and conservation.

### Canada Wild-rye

Canada wild-rye is a bunchgrass abundant in parts of western North Dakota, South Dakota, Nebraska, and all States to the west. It is adapted to a wide range of soil types but is most productive on fertile loams. Seedlings quickly form a good protective cover, but they begin growing about a week later in the spring than crested wheatgrass. This grass is more likely to continue growing during the summer than wheatgrass, but it will stop during a drought and then resume in the fall.

### Russian Wild-rye

Russian wild-rye is a bunchgrass adapted to the drier sites of the same States in which Canada wild-rye is grown, and is similar in adaptation to soil types. Russian wild-rye provides spring and summer grazing and remains palatable during its entire grazing period. Although forage yields are low, on soils of low fertility the gains made by livestock on the grass are generally high. When nitrogen and irrigation are supplied, yields are quite large. In either case the forage is high in quality. It is a salt-tolerant grass but a poor seed producer.

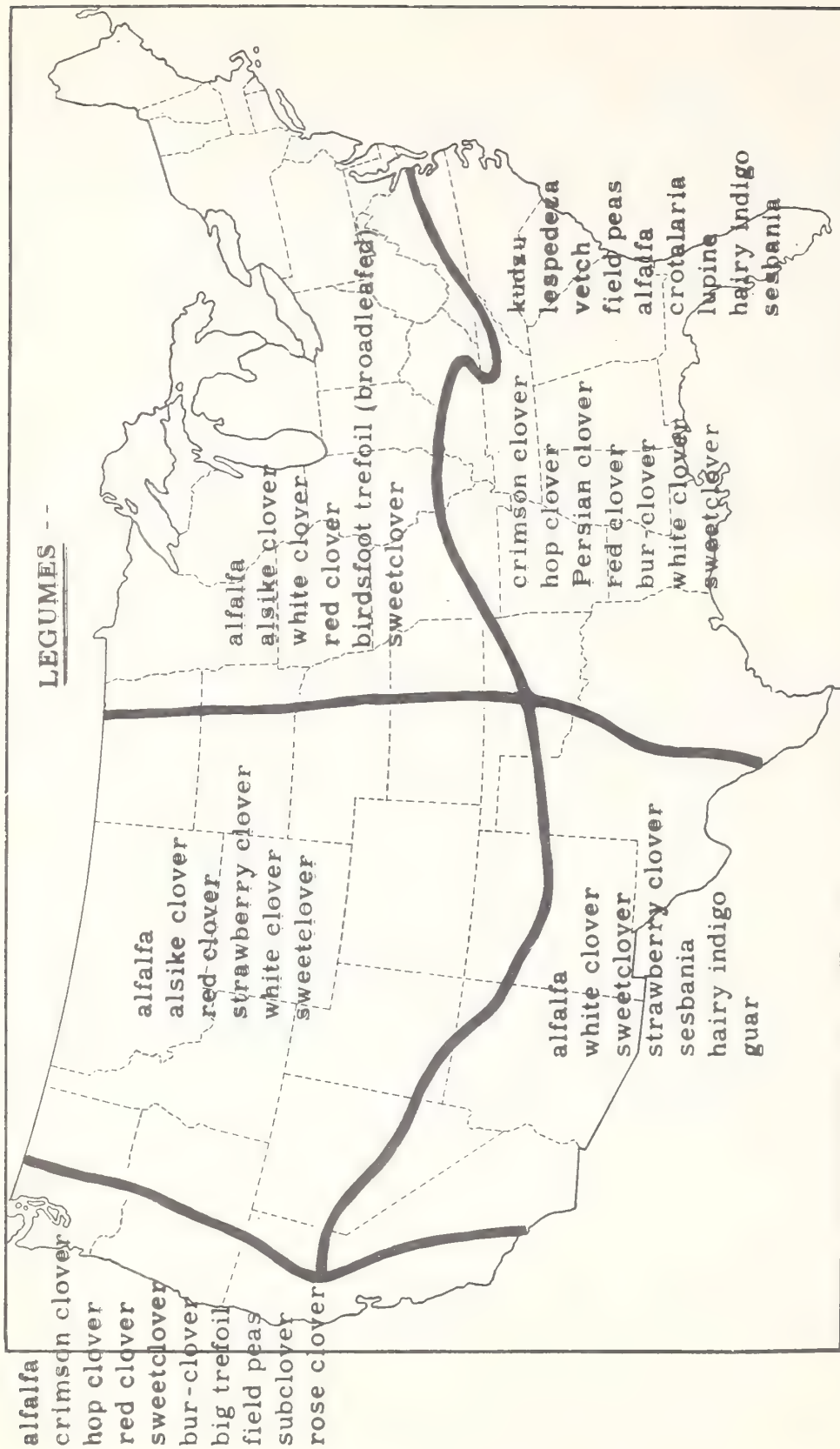


Figure 2.--Generalized regions of adaptation for principal legumes. Certain legumes may be adapted to only specific areas within regions.

## LEGUMES

Legumes are important to grassland agriculture because they provide nutritious feed for livestock and have the ability to enrich the soil by taking nitrogen from the air and fixing it in the soil. This soil improvement results from tiny Rhizobia bacteria that live on the roots of legumes, their presence and beneficial activity there being evidenced by nodules that form on the roots. Since these bacteria may not exist in the soil, it is advisable to inoculate legume seed, just before planting, with a liquid or humus culture of a specific kind required to provide maximum assurance of root nodule development on the seedling legumes.

The forage legumes included in this report are perennials, biennials, and annuals, and can be used alone or in mixtures with various grasses. Almost all of the legumes mentioned are palatable to livestock.

## ALFALFA

Alfalfa is among the most palatable and nutritious of the forage legumes. It is grown in every State, which indicates its remarkable adaptability to a wide range of climatic and soil conditions. The greatest acreages are found in Michigan, Wisconsin, Minnesota, Iowa, South Dakota, Nebraska, Kansas, and California. Although different varieties are adapted to different climatic conditions, all varieties do well on deep loams with open, porous, well-drained subsoil. None do well on acid soils. A heavy feeder, alfalfa requires an abundance of available plant nutrients for best growth. Alfalfa hay is rich in proteins, minerals, and vitamins. Large tonnages of this high-yielding legume are dehydrated for meal. It also is used for pasture and is a highly effective conservation crop.

Until about 1950 common alfalfa and uncertified seed of named varieties comprised the greater part of the alfalfa seed produced and marketed in this country. Common alfalfa seed was, and is, usually designated by the name of the State or area in which it is produced. These alfalfas and named varieties differ in their winter hardiness and in other characteristics. The genetic purity, hence the traits, of a given variety can best be maintained by growing the seed under seed certification, which requires sufficient isolation to guard against cross pollination with other varieties. Thus, the use of certified seed is the best guarantee of getting genetically pure planting stock which will give satisfactory performance. If common or uncertified seed is to be used, it is advisable to obtain seed that has been grown where the winter temperatures approximate those of the area in which it is to be seeded.

Several new alfalfa varieties have been developed and released in the United States since 1940. Availability of seed has been increasing rapidly since 1950.

Ranger is resistant to bacterial wilt, a serious disease of alfalfa, and is relatively cold resistant. It has no yield advantage over other alfalfas where wilt is not a problem. Its range of adaptation is bounded on the south by a line that runs through central New Jersey,



Maryland, Virginia, Tennessee, Missouri, Kansas, Colorado, Utah, Nevada, and California. Northward its area of adaptation runs to the Canadian border.

Vernal is also wilt resistant and is more winter hardy than Ranger. It is a high producer that withstands early cutting and relatively heavy grazing. It is being grown in Michigan, Wisconsin, Minnesota, and the border areas of adjoining States. Its adaptability to eastern States of the same latitude has not been fully determined.

Buffalo is slightly less resistant to wilt and cold than either Ranger or Vernal. However, it has a wide area of adaptability which extends across the central portion of the United States. On the north the area is bounded by a line running through southern Connecticut and New York, northern Pennsylvania, Ohio, Indiana, and Illinois, and southern Iowa, Nebraska, and Wyoming. In Idaho the line turns northward, proceeding through the northern part of that State and through the northeastern corner of Washington to the Canadian border. On the south the line runs through central North Carolina, northern Georgia, Alabama, and Mississippi, southern Arkansas and Oklahoma, the Texas Panhandle, northern New Mexico and Arizona and then turns north, running through the northeastern corner of Nevada and Oregon and to the coast along the southern border of Washington.

Atlantic is a high-yielding variety with a wide range of adaptation. It is somewhat tolerant of--but not resistant to--bacterial wilt. It is adapted to the area that extends south from southern Maine into North Carolina and west to the Mississippi River. It has also yielded well in Texas, Wyoming, Colorado, Utah, Idaho, and Washington.

Narragansett is a high-yielding variety that has a high degree of cold resistance, but is not particularly resistant to disease. It is adapted to Pennsylvania, New York, Connecticut, Rhode Island, and to the States to the north. Seed increase of this variety has not fully met the demand.

Williamsburg is a high-yielding, persistent, competitive variety under Maryland, Virginia, and North Carolina conditions. It is resistant to stem rot.

Lahontan is noted for its resistance to the spotted alfalfa aphid, a small insect that is capable of killing alfalfa in the early seedling stage and of defoliating and oftentimes killing older plants. The variety is also wilt resistant and practically immune to the stem nematode. Its known range of adaptation includes Nevada, Utah, northern California, and southern Oregon. Within this range it equals Ranger in yield in those areas free of the stem nematode and the spotted alfalfa aphid. In areas infested with these two pests, Lahontan out-yields all other varieties, as well as common. It is now being tested for adaptability in a number of States where the alfalfa aphid has appeared. The variety, however, is highly susceptible to those foliage diseases present in humid areas. It has about the same winter hardiness as Buffalo. Seed supply is somewhat limited.

Caliverde is highly resistant to bacterial wilt, common leaf spot, and downy mildew. It has little cold resistance. The variety is widely used in the central valley of California.

## CLOVER, TRUE

The true clovers are either perennial or annual, although many of the perennial species behave as biennials and annuals because of disease, insect pests, or other unfavorable environmental conditions.

They are grown in almost every State, but in general they thrive in areas with moist cool weather during some period of the growing season. They make the best growth in fertile soils and serve as hay, silage, pasture, or conservation crops. Wide differences exist in the ability of the different species to tolerate unfavorable environments and in their habits of growth, flowering, and reproduction.

### Alsike Clover

Alsike is a perennial clover, but it frequently produces only one hay crop following the seeding year. It is best adapted to humid sections in the northern half of the United States. Alsike is grown, however, in all sections of the country. It requires a cool climate during some part of the year and an abundance of moisture. It makes its best growth on moist heavy silt or clay soils. It is more winter hardy than common red clover and is better adapted to poorly drained, somewhat acid soils, but yields less hay. It is especially suited for hay and permanent pastures on wet, slightly sour land.

### Crimson Clover

Crimson clover is a very important winter annual in the States south of the Ohio River and east of Texas and Oklahoma, and is used in the milder sections of Washington, Oregon, and California. It may also be grown as a summer annual in northern Maine. It thrives in regions having cool, humid weather during the winter months and where temperatures are not severe. Somewhat tolerant of soil acidity, it can be grown on both clay and sandy soils of moderate to high fertility. Its principal advantage in its area of adaptation is its ability to produce large quantities of winter and spring grazing and of seed that can be easily harvested and resown. When reseeding varieties are left to seed naturally, a new stand develops in the fall of each year.

Dixie, Auburn, and Autauga are three very similar reseeding varieties that mature slightly earlier than common crimson. Good stands usually result when the plants reseed because the seeds have hard coats which enable them to lie dormant until autumn, when conditions for plant growth are favorable. Common crimson does not have this characteristic. Close grazing should be avoided during blooming to assure an adequate seed supply. The three varieties grow well in all the States from Virginia to Florida and west to Oklahoma and Texas.

Chief and Talladega are similar to Dixie, Auburn, and Autauga, but they mature 7 to 10 days later.

### Hop Clover

The small and large hop clovers are winter annuals grown in North Carolina, Tennessee, Arkansas, and States to the south, as well as in the



milder sections of Washington and Oregon. They are adapted to a wide range of soil and moisture conditions and provide pasture during the winter and spring. Of the two types the large hop produces more forage and requires a more fertile soil.

### Persian Clover

Persian clover is a winter annual grown in the same area as the hop clovers. It prefers moist heavy soil and will tolerate some alkalinity. The legume serves as a hay, pasture, green manure, or cover crop. Stands volunteer freely from shattered seed.

### Red Clover

Red clover is a perennial that is best adapted to humid sections in the northern half of the United States, but it is grown in all sections of the country. It makes its heaviest growth on fertile, well-drained soils containing an abundance of lime and adequate amounts of phosphorus. It is widely grown for pasture, hay, or silage in short rotations with small grains and corn.

There are two types of red clover--mammoth and medium. Mammoth usually provides only one cutting of hay, and, consequently, acreages are small and seed supply limited. Medium, on the other hand, usually provides two cuttings and matures earlier. All varieties are grown in the Western States for forage and particularly for seed. The following varieties of medium red clover are in general use:

Dollard is a winter-hardy variety that is moderately resistant to northern anthracnose. It is adapted to Minnesota and to all of the States to the east that border Canada. Although the supply of certified Dollard seed was somewhat limited in the spring of 1957, increased quantities will be available in 1958.

Kenland is highly resistant to southern anthracnose and slightly resistant to crown rot. Good harvests are obtained the second year. It is adapted to the band of States that extend westward to the Missouri and Mississippi rivers from Pennsylvania, New Jersey, Delaware, Maryland, Virginia, and North Carolina.

Pennscott is noted for its early seedling vigor, but it seldom persists as long as Kenland under the same conditions. It is particularly adapted to New York, Pennsylvania, New Jersey, Delaware, and adjoining areas.

Midland has some resistance to northern anthracnose, is winter hardy, and possesses good seedling vigor. It is adapted to Minnesota, Wisconsin, Michigan, and the northern halves of Iowa, Illinois, Indiana, and Ohio.

### Rose Clover

Rose clover is a reseeding winter annual grown in California. It will grow on many soils of relatively low fertility but is benefited by the use of phosphate fertilizers. The plant is very palatable and will withstand heavy grazing. It can be seeded with a companion crop or included in a grass-and-legume pasture mixture. It is a desirable conservation crop as well as a pasture crop.

## Strawberry Clover

Strawberry clover is a low-growing perennial that is adapted to wet soils in Montana, Wyoming, western Nebraska, Colorado, and New Mexico and westward to the Pacific Coast. It withstands flooding and a wide range of temperatures. It prefers saline soils, although it also grows well on non-saline soils in the above regions. It is an excellent pasture and soil-improvement crop for wet lands.

Salinas, the only variety produced to date, is less winter hardy than common. It is grown in central and southern California.

## Subclover

Subclover is an annual legume grown extensively on the coastal ranges of Washington, Oregon, and California. Tests show that it is a promising crop in the lower Piedmont and coastal plains of South Carolina, Mississippi, Louisiana, Georgia, Alabama, and Florida. It requires cool, moist winters, and well-drained soils that contain adequate amounts of phosphate. The legume provides winter and spring pasture on land where drought prevails during the summer months. The name, subclover, is derived from the plant's habit of burying its seed heads in the soil as they mature.

## White Clover

White clover is widely used throughout the United States for pastures and lawns. Like all clovers, it requires a moist, cool climate during some part of the year, but it will withstand greater extremes of temperature than either red or alsike clover. White clover prefers moist clays or loams; it does not grow well on strongly acid soils. There are three general types of white clover: large, intermediate, and low-growing. The low-growing type is better adapted for lawns and has no importance as a forage plant.

Ladino is a variety of the large type. It exceeds ordinary white clover in size of leaves, stolons, flower heads, and yield where adapted. It produces a highly nutritious hay or pasture crop. It grows well in Minnesota, Iowa, Missouri, Arkansas, Louisiana, and States eastward to the Atlantic Ocean. It can also be grown under irrigation in other States. Continuous close grazing or cutting late in the fall in the Northern States is not recommended.

Pilgrim, a variety of white clover similar to Ladino, is somewhat longer lived in Pennsylvania, Maryland, New Jersey, Delaware, and in parts of adjoining States.

Louisiana White is a naturalized reseeding intermediate type that has been grown in Louisiana and adjoining areas for many years.

Louisiana S-1 is a more vigorous-growing and higher-yielding variety than Louisiana White. Its reseeding habit and climatic adaptation is similar to those of Louisiana White.

Nolin White is a selection from Louisiana White that is higher yielding and somewhat more persistent than its parent.



## CROTALARIA

The crotalaria are coarse-stemmed, upright legumes usually grown as summer annuals, although some species are short-lived perennials. This legume group is grown in the southern part of North Carolina and in South Carolina, Georgia, Florida, Alabama, Mississippi, and Louisiana. The crotalaria make their best growth on well-drained, light sandy soils but they also grow well on acid soils of low fertility. They are used principally as a cover crop although some species have value as forage. All species are noted for their resistance to root-knot nematodes. Showy crotalaria (C. spectabilis) and Sunn (C. juncea) contain monocrotaline, an alkaloid that is toxic to livestock. However, few cases of crotalaria poisoning have been reported.

## CROWN VETCH

Crown vetch is the common name of a legume which belongs to a different family than hairy, common, or purple vetch. It is grown in Pennsylvania on the lighter and poorer soils, and along road embankments and waterways. It is a good conservation crop since it forms a deep vegetative mat. Livestock find it unpalatable. Seed stocks are very limited.

## FIELD PEAS

Field peas are annual legumes grown in most of the States. Cool weather in some part of the year is necessary for proper growth, and abundant rainfall is essential to maximum production. Fair yields are obtained in the cool, semiarid regions.

Field peas are grown in the summer for seed, hay, silage, and pasture in the northern States from New York westward to Washington and Oregon. They are grown in the winter as cover or green manure crops in Virginia, Tennessee, Arkansas, eastern Oklahoma, and States to the south, and in western Washington and Oregon. They prefer well-drained clay loams.

Austrian winter peas yield large quantities of green manure on soils supplied with adequate amounts of phosphorus. The forage is succulent and decays quickly and the root system is extensive, thus providing the soil with large amounts of humus. The plant is less winter hardy than hairy vetch but is adapted to the Southeastern States. Seeds germinate quickly, and good stands are usually obtained. It is used in rotations with cotton and corn, and is also planted in orchards to supply plant food to the growing trees. Austrian winter peas are susceptible to leaf spot, leaf blotch, bacterial blight, powdery mildew, black stem, stem rot, and root rot.

Romack is earlier and more productive than Austrian winter peas but is slightly less winter hardy. It is subject to the same diseases that attack Austrian winter peas, but it is more resistant to root rot. It is best adapted to southern parts of South Carolina, Georgia, Alabama, Mississippi, and Louisiana, and to Florida.

Dixie Wonder is a very early maturing variety that is even less winter hardy than Romack. Its area of adaptation is slightly farther south than Romack. Seed supply is somewhat limited.

Papago is a new variety that grows well under irrigation and is more productive than other varieties in the Southwest, its known area of adaptation. It is being grown for seed increase in Arizona, and seed supply is still limited.

## GUAR

Guar is a drought-resistant summer annual that can be grown in most of the States south of Virginia, Kentucky, Missouri, Kansas, Colorado, Utah, and Nevada, and in southern California. Commercial acreages are confined to southern Texas, Arizona, and California.

Guar grows best on sandy loams but it does well on a wide range of soils. It is an excellent green-manure crop for cotton lands infected with root rot, to which guar is highly resistant. Guar also possesses moderate resistance to the root-knot nematode. The plants are too coarse and woody to use for forage, but the beans can be fed as a protein supplement to live-stock or processed to produce a vegetable gum, mannogalactan, which has a variety of uses for food, paper, and textile products.

## HAIRY INDIGO

Hairy indigo is a summer annual adapted to the Gulf Coast from Florida to Texas. It grows fairly well on moderately poor sandy soil but does best on fertile sandy loams. It has a low lime requirement. It serves as a conservation or pasture crop, and hay can be harvested if cut before the plant reaches a height of 2-1/2 to 3 feet. Hay from taller plants is usually woody and unpalatable. It is a heavy seed producer and is resistant to the root-knot nematode. Two types are recognized: a large late-maturing strain and a smaller type which matures about 1 month earlier.

## KUDZU

Kudzu is a rapid-growing, viny, perennial plant, adapted to Virginia, Kentucky, Arkansas, eastern Oklahoma, and States to the south. It can be grown in the irrigated sections of Arizona, New Mexico, and southern California as well as the coastal sections of Washington and Oregon.

Kudzu grows best on well-drained loams of good fertility, but it will grow on soils of almost all types except very light sand and poorly drained heavy clay.

Kudzu excels as a conservation crop, but it is also used as a pasture and hay crop. Stands may be lost if they are clipped closely or overgrazed. Most stands are established by planting crowns. Very little seed is available.

## LESPEDeza

The lespedezas are legumes whose areas of adaptation vary with the species. They will grow on almost any type of soil, including those too sour for clover, but they make their best growth on fertile, well-drained loams. There are three commonly grown species: two annuals--*striate* and *Korean*--and one perennial--*sericea*. The annuals are usually spring sown

in small grain for use as hay or grazing after the small grain is harvested. The perennial is usually planted alone.

### Striate Lespedeza

Striate lespedeza is grown in the area south of an irregular line that runs through southern New Jersey and Pennsylvania, central Ohio, Indiana, and Illinois, and through southern Iowa into eastern Kansas. Common and Kobe are the recognized varieties of striate lespedeza. In the northern limits of its range, common is a low-growing pasture plant only, but farther south it can be cut for hay. Kobe is later maturing and more widely used than noncertified striate. It is frost sensitive and is grown only as far north as North Carolina, Tennessee, Arkansas, and eastern Oklahoma.

### Korean Lespedeza

Korean lespedeza is grown in the more northern part of the striate lespedeza area--in southern New Jersey, Pennsylvania, Ohio, Indiana, Illinois, and Iowa; in eastern Kansas and Oklahoma; and in Virginia, West Virginia, Kentucky, Missouri, North Carolina, Tennessee, and Arkansas. It has the same soil preferences and uses as striate.

Climax is a late-maturing variety that can be grown farther south than common Korean and produces larger yields of hay.

Rowan is a productive new variety of Korean maturity that carries resistance to two species of root-knot nematodes and to powdery mildew.

Iowa 6 is an early-maturing variety adapted to the most northern part of the lespedeza belt. It is grown for hay and for late summer pasture.

### Sericea Lespedeza

Sericea lespedeza is adapted to the area lying south of the Ohio River and east of central Kansas and Oklahoma, except for southern Florida. It is erratic in its cold tolerance; it has survived the winter in both Michigan and Vermont, and yet has failed to survive in areas with less severe temperatures.

Sericea lespedeza grows well on poor eroded clays, clay loams, or silt loams, but maximum yields are obtained on more fertile soils.

The legume serves as a conservation, hay, or pasture crop. It is not as palatable as most legumes, particularly after it reaches 12 inches in height. The high tannin content and the coarse stems of the forage are believed responsible for its unpalatability.

## LUPINE

The lupines serve as winter annuals in South Carolina, Georgia, Florida, and Alabama. The early introductions of these species were poisonous because of the high alkaloid content of the leaves and seed.



Sweet or low-alkaloid varieties have been developed in recent years. These newly developed, nonpoisonous lupines are grown for forage and for soil improvement.

### Borre Blue Lupine

Borre blue lupine, a sweet type, is adapted to the southern parts of South Carolina, Georgia, and Alabama, as well as the northern part of Florida. It grows well on sandy and more acid soils in these areas. It is used as a soil-improvement crop, furnishes palatable winter grazing, and, in addition, the seed can serve as a high-protein feed supplement. It fits well into a crop rotation with sorghum or sudangrass to provide year around forage.

### Yellow Lupine

Yellow lupine, which is grown in northern Florida and southern Georgia, is the sweet type and has the same soil preferences as Borre blue lupine. It is equally important for soil improvement and winter grazing. In recent years virus diseases have greatly reduced seed yields.

### MEDICAGO

The medicagos are winter annual legumes that maintain themselves readily by natural reseeding. The medicagos are not true clovers but, because of their physical resemblance, many species are commonly called clovers.

### Bur-clover

The bur-clovers are adapted to the cotton-growing areas of the South and to western Washington, Oregon, and California. These legumes prefer moist, well-drained limestone loams. They will, however, make good growth in practically all types of soils, and in California will grow vigorously on poorly drained alkaline soils.

Bur-clovers are grown as winter cover crops to increase soil fertility and limit erosion. They may also be used for grazing, but they are less palatable than white clover. Sheep raisers do not favor bur-clover on ranges since the burs become entangled in the fleece and reduce the value of the wool.

Southern bur-clover makes unusual growth during cool weather in all but the coastal areas of those States south of Virginia, Kentucky, and Missouri. Although it maintains itself, Southern bur-clover is a difficult crop to harvest for seed.

California bur-clover is more susceptible to low temperatures than Southern bur-clover. It provides winter range in those sections of California, Arizona, and Texas having mild winters.

### Button Clover

Button clover is grown in Tennessee and in northern Alabama and Mississippi. It grows well on well-drained heavy soils and is used for pasture, hay, and soil improvement.

## Cogwheel Clover

Cogwheel clover is grown to a limited extent in Texas on well-drained clay and clay loam soils. It is used for winter pasture and for soil improvement.

## Black Medic

Black medic grows in North Carolina, Tennessee, Arkansas, and States to the south. It produces best on the heavier soils and tolerates relatively dry winters. It is used both as a conservation and a pasture crop. The plant is distributed naturally in pastures, waste places, and meadows.

## ROUGHPEA

Roughpea, a reseeding winter annual, is grown in North Carolina, Tennessee, Arkansas, eastern Oklahoma, and States to the south. It is also known as singletary, caley, and wild winter pea in various sections of the cotton-producing area. The plant prefers well-drained limestone soils, but grows well on the average acid soils of the South, and on the heavy soils of Mississippi and Alabama. Used for hay, pasture, and soil improvement, roughpea begins growth in the late winter and early spring and continues to midsummer, when it matures. Grazing should be discontinued when the plants begin flowering, since roughpea is poisonous to livestock at maturity.

## SESBANIA

Sesbania is a native legume found in New Mexico, Arizona, and the States bordering the Gulf of Mexico. It makes good growth on river bottom locations in both the Southwest and Midsouth. It prefers rich loam soils. Sesbania is a valuable green manure crop, but it is not sufficiently palatable to be used for forage.

## SWEETCLOVER

Sweetclovers, which may be either biennials or annuals, are widely grown in Ohio, Indiana, Illinois, Minnesota, Iowa, Missouri, the Dakotas, Nebraska, Kansas, Oklahoma, Texas, eastern Montana, Wyoming, and Colorado, and, to a lesser extent, in Florida, Washington, Oregon, and California. They will grow wherever 17 or more inches of rain falls annually and the soil is not acid.

This legume serves principally as a pasture or conservation crop. Nutritionally, it is not equal to alfalfa or red clover for hay. Sweetclover hay must be properly cured or ensiled for storage. The green plants contain a substance called "coumarin," which, in improperly cured hay or silage, may decompose into "dicumarol." When spoiled hay or silage is fed to cattle, dicumarol may cause both internal and external bleeding.

There are two important species of white sweetclover--biennial yellow and biennial white. Biennial yellow possesses greater tolerance to drought than biennial white and therefore is better adapted to the Great Plains.

Because it matures earlier it is a more reliable seed producer. On the other hand, biennial white produces higher yields of forage and green manure and provides grazing during the second year.

There is, in addition, an annual form of the white species and an annual yellow species, but these are limited in their adaptation.

The following varieties of yellow and white sweetclover are being grown:

Madrid is a biennial yellow noted for its early seedling vigor and its tolerance of frost during the first year. It is slightly later than common yellow but more productive. It is adapted to all States in the sweetclover area.

Goldtop is a later-maturing biennial yellow that is adapted to Minnesota, Iowa, Missouri, Kansas, Nebraska, and parts of Washington. Seed supply will be somewhat limited until 1959.

Spanish is a biennial white that possesses good seedling vigor, matures in midseason, and is a heavy seed producer. It is adapted to the same area as Goldtop.

Evergreen is a late-blooming biennial white that produces rank, heavy growth and high yields. It is also adapted to the same area as Goldtop.

Hubam is an annual white sweetclover that provides winter pasture in Florida, southern Texas, and in irrigated sections of Arizona, New Mexico, and Texas. It is also grown as a summer green manure crop in Idaho, Washington, and Oregon.

Floranna is also an annual white adapted to the same area as Hubam but which produces more winter growth in Florida and southern Texas.

Sour clover is a winter annual yellow sweetclover adapted to coastal sections of States bordering the Gulf of Mexico and to southern New Mexico, Arizona, and California.

## TREFOIL, BIRDSFOOT

Birdsfoot trefoil is a temperate-climate legume that produces better in the northern half of the United States than in the southern half. It grows best on rich soils, but produces well on less fertile, poorly-drained clay and silty clay loams, and it will also tolerate moderate quantities of alkali. The plant serves as a hay, pasture, or conservation crop. Two types are recognized: broadleafed and narrowleafed.

### Broadleafed Birdsfoot Trefoil

The broadleafed varieties are adapted to New Jersey, Pennsylvania, Ohio, Indiana, Illinois, Missouri, eastern Kansas and the area to the north, and to Washington and Oregon. Fringe areas of adaptation include parts of Delaware, Maryland, Virginia, North Carolina, Kentucky, Tennessee, Missouri, Arkansas, Oklahoma, and California. Several varieties are important.



Viking is an early, high-yielding, winter-hardy variety. It has good seedling vigor, starts early in the spring, and recovers rapidly after cutting. It can be grown anywhere in the trefoil area and is particularly adapted to the Northern States. It blooms about the same time as red clover.

Empire is a very winter-hardy, low-growing trefoil, better suited to pasture production than the other varieties. It blooms 10 to 20 days after alfalfa, red clover, and the European-type trefoils--Viking, Cascade, and Granger. It is lower yielding than Viking but persists well under heavy grazing once it is established. It is adapted to the same area as Viking.

Mansfield is a new variety that shows promise in Vermont. Additional testing is necessary to determine its advantages and areas of adaptation.

Cascade and Granger have good seedling vigor, are easy to establish, provide abundant hay, and recover rapidly after cutting. Developed for Washington and Oregon, both varieties have shown promise in Ohio, Indiana, Illinois, and Missouri.

Douglas is a new variety, similar to Cascade and Granger, that is grown in Oregon.

Tana is adapted to Montana. Seed production is just getting underway.

### Narrowleafed Birdsfoot Trefoil

Narrowleafed trefoil is slightly less productive and lower-growing than broadleafed trefoil, and is tolerant of saline soils. It is grown in the irrigated sections of California, Oregon, Idaho, and Nevada, where it is used mainly as a pasture legume. It will withstand heavy grazing.

## TREFOIL, BIG

Big trefoil occurs in Washington and Oregon. The plant favors fairly acid peat or muck soils and has little or no drought tolerance. It also shows promise on poorly-drained, marshy soils found in the flatwood sections of those States east of the Mississippi and south of Virginia and Kentucky. It is used for hay and pasture.

## VETCH

Vetches are vining or weak-stemmed annuals which require cool temperatures during some part of the year for best development. Certain varieties can be grown in all regions of the United States where adequate moisture is available. Regardless of location the vetches prefer deep loam soils, but some varieties require less fertile soils than others. All are tolerant of acidity. They are grown for hay, pasture, or soil improvement. Their season of production depends upon their geographical location: In the South they make their best growth in winter and early spring, while in the North they start growth early in the spring and mature late in the summer or fall. Hairy, common, purple, Hungarian, and woollypod vetches are the kinds most commonly grown in the United States.

## Hairy Vetch

Hairy vetch grows in all regions of the United States, but the largest acreages are in Washington and Oregon, and in Oklahoma, Texas, and States eastward to the Atlantic. It does well on fertile sandy soils and rich loams. In the Cotton Belt it provides early spring grazing and serves as a soil-improving cover crop. In more northern latitudes, hairy vetch may be seeded alone or with small grains to provide seed or hay. It is also used in these areas for pasture and soil improvement.

## Common Vetch

Common vetch is adapted to the same general area and soil conditions as hairy vetch, but it is less winter hardy. It occasionally winterkills in western Oregon and Washington and frequently winterkills in the northern sections of the Cotton Belt. In Washington and Oregon it is grown as a hay and seed crop, and for green manure, silage, and pasture. In the South-eastern States it is used largely for green manure.

Willamette is the most winter-hardy variety of common vetch, is vigorous growing, and is adapted to Washington, Oregon, and to all States east of the Mississippi and south of Tennessee.

## Purple Vetch

Purple vetch--the least winter hardy of the vetches--is grown in the milder sections of California and Oregon, where it serves as a pasture, green manure, or hay crop.

## Hungarian Vetch

Hungarian vetch is grown in Washington and Oregon where it is especially well adapted to heavy clay soils. In this region it is grown for hay, silage, green manure, pasture, and seed.

## Woollypod Vetch

Woollypod vetch is similar to hairy vetch in appearance and adaptation but is slightly less winter hardy. It is more productive than hairy vetch in the Southeastern States. Seed stocks are limited but are being increased in the Western States.



# INDEX

alfalfa - - - - -	19	lovegrass - - - - -	9
alsike clover - - - - -	21	lupine - - - - -	26
Bahiagrass - - - - -	11	meadow foxtail - - - - -	10
Bermudagrass - - - - -	3	medicago - - - - -	27
big bluegrass - - - - -	4	mountain brome - - - - -	6
big bluestem - - - - -	4	narrowleafed birdsfoot trefoil -	30
big trefoil - - - - -	30	oatgrass, tall - - - - -	15
birdsfoot trefoil - - - - -	29	orchardgrass - - - - -	10
black medic - - - - -	28	pangolagrass - - - - -	11
blue grama - - - - -	8	panicgrass - - - - -	11
bluegrass - - - - -	4	paspalum - - - - -	11
blue panicgrass - - - - -	11	pearl millet - - - - -	12
bluestem - - - - -	4	perennial ryegrass - - - - -	13
Borre blue lupine - - - - -	27	Persian clover - - - - -	22
brome - - - - -	5	pubescent wheatgrass - - - - -	16
broadleafed birdsfoot trefoil -	29	purple vetch - - - - -	31
buffalograss - - - - -	7	red clover - - - - -	22
buffelgrass - - - - -	7	redtop - - - - -	12
bur-clover - - - - -	27	reed canarygrass - - - - -	12
button clover - - - - -	27	rescuegrass - - - - -	6
Canada wild-rye - - - - -	17	Rhodesgrass - - - - -	12
carpetgrass - - - - -	7	rose clover - - - - -	22
Caucasian bluestem - - - - -	5	roughpea - - - - -	28
clover, true - - - - -	21	Russian wild-rye - - - - -	17
cogwheel clover - - - - -	28	ryegrass - - - - -	13
common vetch - - - - -	31	St. Augustinegrass - - - - -	13
crested wheatgrass - - - - -	15	sand bluestem - - - - -	5
crimson clover - - - - -	21	sand lovegrass - - - - -	10
crotalaria - - - - -	24	Sericea lespedeza - - - - -	26
crown vetch - - - - -	24	sesbania - - - - -	28
Dallisgrass - - - - -	11	sideoats grama - - - - -	8
dropseed - - - - -	7	smooth brome - - - - -	6
fairway wheatgrass - - - - -	16	stipagrass - - - - -	13
fescue - - - - -	8	strawberry clover - - - - -	23
field peas - - - - -	24	Striate lespedeza - - - - -	26
green needlegrass - - - - -	13	subclover - - - - -	23
grama - - - - -	8	Sudangrass - - - - -	14
guar - - - - -	25	sweetclover - - - - -	28
Hardinggrass - - - - -	9	switchgrass - - - - -	14
hairy indigo - - - - -	25	tall fescue - - - - -	8
hairy vetch - - - - -	31	tall oatgrass - - - - -	15
hop clover - - - - -	21	tall wheatgrass - - - - -	17
Hungarian vetch - - - - -	31	timothy - - - - -	15
Indian ricegrass - - - - -	9	trefoil, big - - - - -	30
intermediate wheatgrass - - - -	16	trefoil, birdsfoot - - - - -	29
Italian ryegrass - - - - -	13	true clover - - - - -	21
Johnsongrass - - - - -	9	Turkestan bluestem - - - - -	5
Kentucky bluegrass - - - - -	4	vetch - - - - -	30
Korean lespedeza - - - - -	26	weeping lovegrass - - - - -	9
kudzu - - - - -	25	wheatgrass - - - - -	15
Lehman lovegrass - - - - -	10	white clover - - - - -	23
lespedeza - - - - -	25	wild-rye - - - - -	17
little bluestem - - - - -	5	woollypod vetch - - - - -	31
		yellow lupine - - - - -	27





